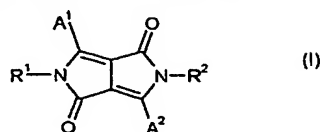


66

## Claims

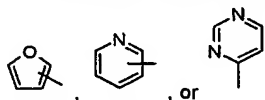
1. A fluorescent diketopyrrolopyrrole of the formula I



, wherein

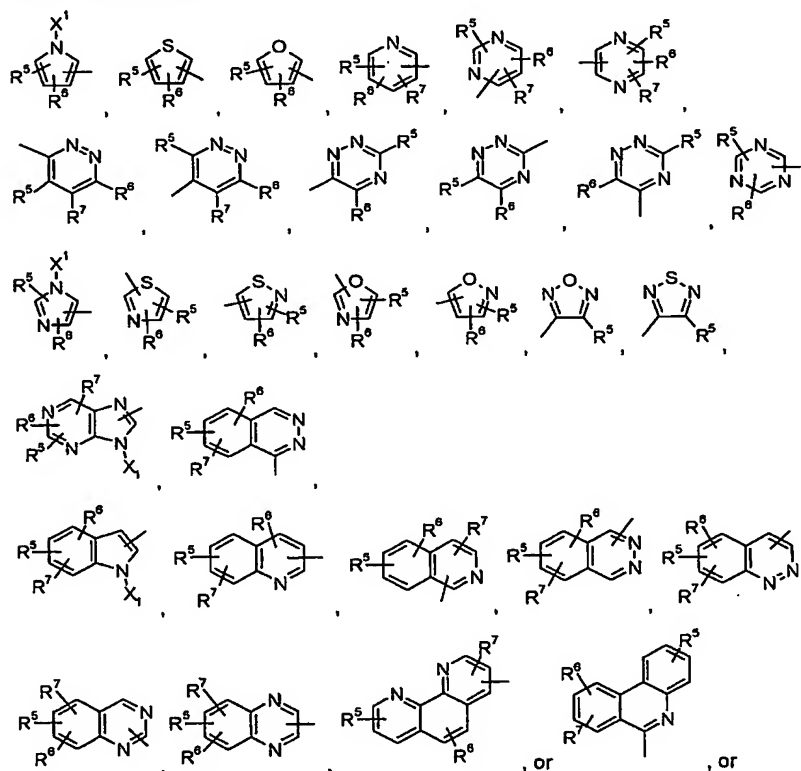
- 5 R¹ and R² may be the same or different and are selected from a C₁-C₂₅alkyl group, which can be substituted by fluorine, chlorine or bromine, an allyl group, which can be substituted one to three times with C₁-C₄alkyl, a cycloalkyl group, a cycloalkenyl group, which can be condensed one or two times by phenyl which can be substituted one to three times with C₁-C₄alkyl, halogen, nitro or cyano, an alkenyl group, a cycloalkenyl group, an alkynyl group, a haloalkyl group, a haloalkenyl group, a haloalkynyl group, a ketone or aldehyde group, an ester group, a carbamoyl group, a ketone group, a silyl group, a siloxanyl group, A³ or -CR³R⁴-(CH₂)ₘ-A³ wherein
- 10 R³ and R⁴ independently from each other stand for hydrogen or C₁-C₄alkyl, or phenyl which can be substituted one to three times with C₁-C₄alkyl,
- 15 A³ stands for aryl or heteroaryl, in particular phenyl or 1- or 2-naphthyl which can be substituted one to three times with C₁-C₈alkyl and/or C₁-C₈alkoxy, and m stands for 0, 1, 2, 3 or 4,
- A¹ and A² are independently of each other a group comprising a five-membered heterocyclic ring, containing one to three heteroatoms selected from the group of
- 20 nitrogen, oxygen and sulfur, or a six-membered heterocyclic ring, containing one to three heteroatoms selected from the group of nitrogen, oxygen and sulfur, wherein, if

A¹ and A² are a single five- or six-membered heterocyclic ring of formula ,

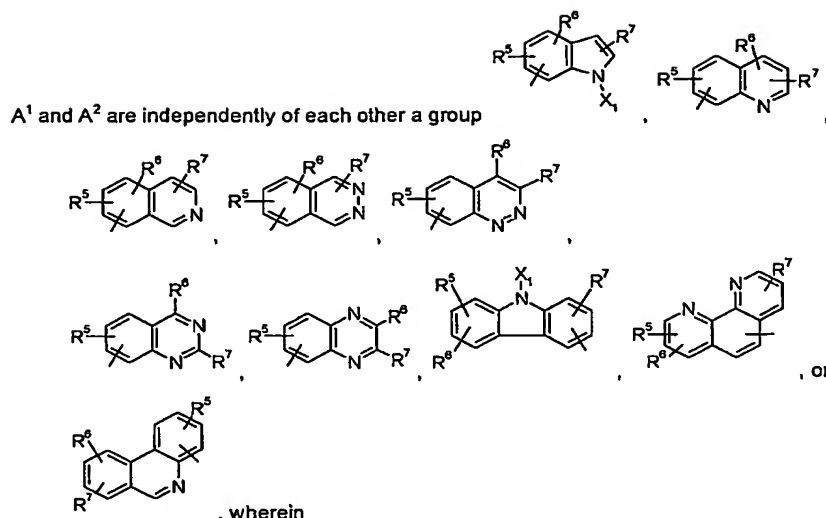


- 25 , said heterocyclic ring is substituted by at least a group selected from a C₁-C₂₅alkyl group, a cycloalkyl group, an aralkyl group, an alkenyl group, a cycloalkenyl group, an alkynyl group, a hydroxyl group, a mercapto group, an alkoxy group, an alkylthio group, an aryl ether group, an aryl thioether group, an aryl group, a heterocyclic group, a halogen atom, a haloalkyl group, a haloalkenyl group, a haloalkynyl group, a cyano group, an aldehyde group, a carboxyl group, an ester group, a carbamoyl group, an amino group, a nitro group, a silyl group, a siloxanyl group, a

substituted or unsubstituted vinyl group, a group  $\text{NR}^8\text{R}^9$ , wherein  $\text{R}^8$  and  $\text{R}^9$  independently of each other stand for a hydrogen atom, an alkyl group, a cycloalkyl group, an aryl group, a heteroaryl group, a heterocyclic group, an aralkyl group, or  $\text{R}^8$  and  $\text{R}^9$  together with the nitrogen atom to which they are bonded form a five or six membered heterocyclic ring, which can be condensed by one or two optionally substituted phenyl groups, wherein the heterocyclic ring is directly bonded to the DPP basis unit, especially



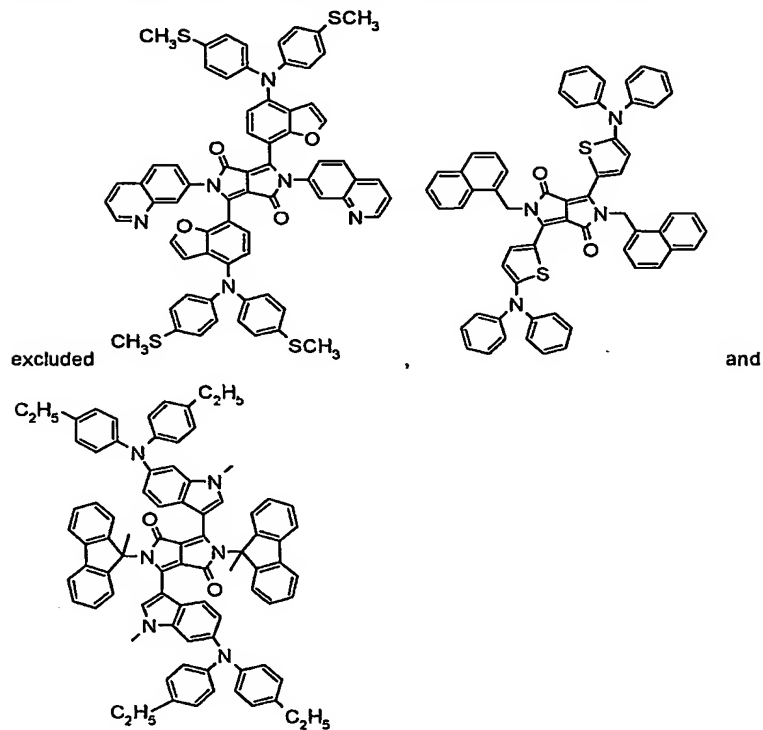
68



- 5 R<sup>5</sup>, R<sup>6</sup>, and R<sup>7</sup> may be the same or different and are selected from a hydrogen atom, a C<sub>1</sub>-C<sub>25</sub>alkyl group, a cycloalkyl group, an aralkyl group, an alkenyl group, a cycloalkenyl group, an alkynyl group, a hydroxyl group, a mercapto group, an alkoxy group, an alkylthio group, an aryl ether group, an aryl thioether group, an aryl group, a heterocyclic group, a halogen atom, a haloalkyl group, a haloalkenyl group, a haloalkynyl group, a cyano group, an aldehyde group, a carboxyl group, an ester group, a carbamoyl group, a nitro group, a silyl group, a siloxanyl group, a substituted or
- 10 unsubstituted vinyl group, a group NR<sup>8</sup>R<sup>9</sup>, wherein R<sup>8</sup> and R<sup>9</sup> independently of each other stand for a hydrogen atom, an alkyl group, a cycloalkyl group, an aryl group, a heteroaryl group, a heterocyclic group, an aralkyl group, or R<sup>8</sup> and R<sup>9</sup> together with the nitrogen atom to which they are bonded form a five or six membered heterocyclic ring, which can be condensed by one or two optionally substituted phenyl groups, or at least two adjacent substituents R<sup>5</sup> to R<sup>7</sup> form an aromatic or aliphatic fused ring system, and
- 15 X<sup>1</sup> is a hydrogen atom, a C<sub>1</sub>-C<sub>25</sub>alkyl group, a cycloalkyl group, an aralkyl group, an aryl group, or a heterocyclic group, wherein at least one of the groups R<sup>5</sup>, R<sup>6</sup>, and R<sup>7</sup> is different from a hydrogen atom, if A<sup>1</sup> and A<sup>2</sup> are a single five- or six-membered heterocyclic ring, containing one heteroatom selected from the group of nitrogen,
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69

oxygen and sulfur, with the proviso, that the following compounds are

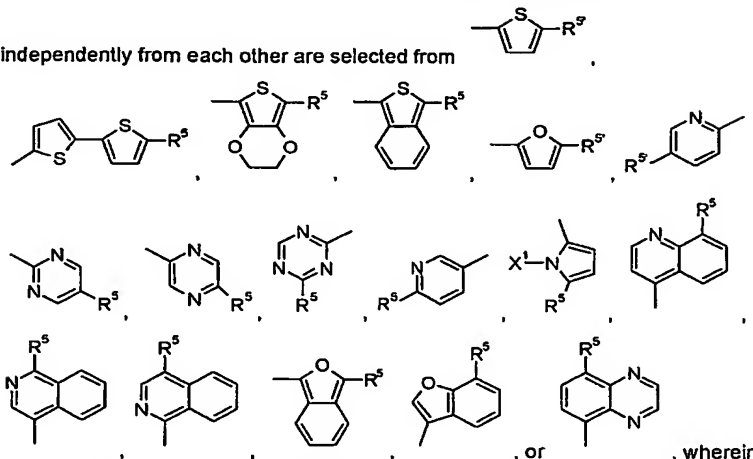


- 5 2. A fluorescent diketopyrrolopyrrole according to claim 1, wherein  $R^1$  and  $R^2$  independently from each other are selected from  $C_1$ - $C_8$ alkyl,  $C_5$ - $C_{12}$ -cycloalkyl, which can be substituted one to three times with  $C_1$ - $C_8$ alkyl and/or  $C_1$ - $C_8$ alkoxy, or  $C_5$ - $C_{12}$ -cycloalkyl, which can be condensed one or two times by phenyl which can be substituted one to three times with  $C_1$ - $C_4$ -alkyl, halogen, nitro or cyano, phenyl or 1- or 2-naphthyl which can be substituted one to three times with  $C_1$ - $C_8$ alkyl and/or  $C_1$ - $C_8$ alkoxy, or  $-CR^3R^4-(CH_2)_m-A^3$  wherein  $R^3$  and  $R^4$  stand for hydrogen,  $A^3$  stands for phenyl or 1- or 2-naphthyl, which can be substituted one to three times with  $C_1$ - $C_8$ alkyl and/or  $C_1$ - $C_8$ alkoxy, and  $m$  stands for 0 or 1.
- 10

70

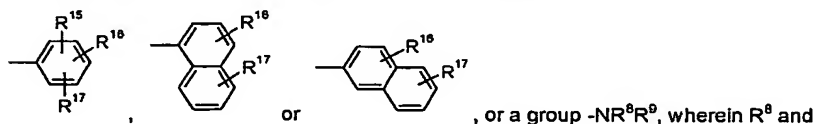
3. A fluorescent diketopyrrolopyrrole according to claim 1, wherein A<sup>1</sup> and A<sup>2</sup>

independently from each other are selected from



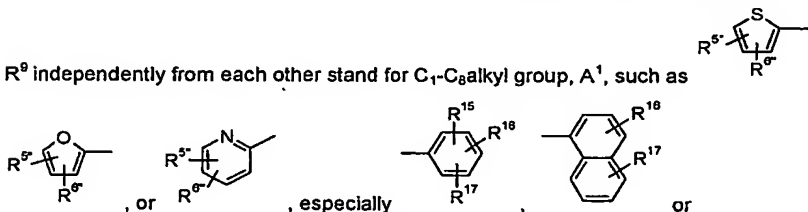
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R<sup>5</sup> is a hydrogen atom, a C<sub>1</sub>-C<sub>12</sub>alkyl group, a C<sub>1</sub>-C<sub>8</sub>alkoxy group, a group of formula



, or a group -NR<sup>8</sup>R<sup>9</sup>, wherein R<sup>8</sup> and

R<sup>9</sup> independently from each other stand for C<sub>1</sub>-C<sub>8</sub>alkyl group, A<sup>1</sup>, such as



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, or R<sup>8</sup> and R<sup>9</sup> together with the nitrogen atom to which they are bonded form a five or six membered heterocyclic ring which can be condensed by one

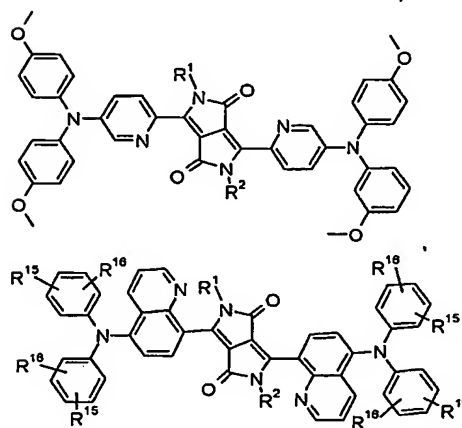
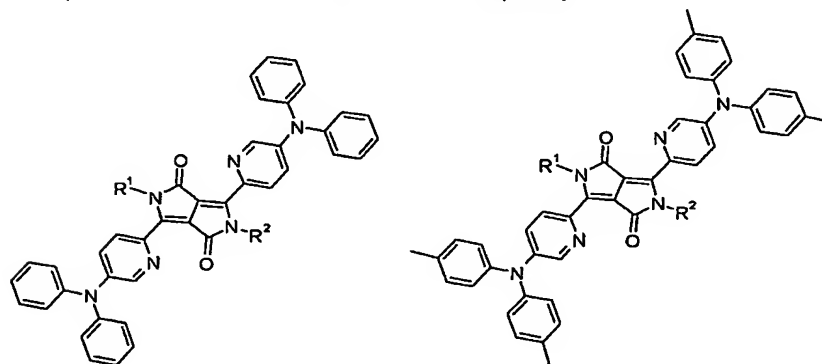
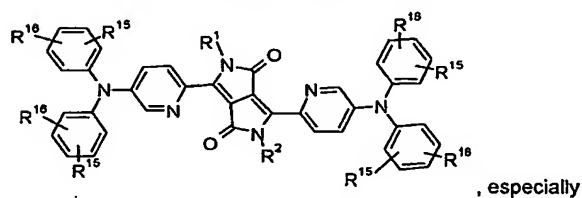
or two optionally substituted phenyl groups, such as

, wherein R<sup>15</sup>, R<sup>16</sup> and R<sup>17</sup> independently from each other stands for hydrogen, C<sub>1</sub>-C<sub>8</sub>-alkyl, C<sub>1</sub>-C<sub>8</sub>-

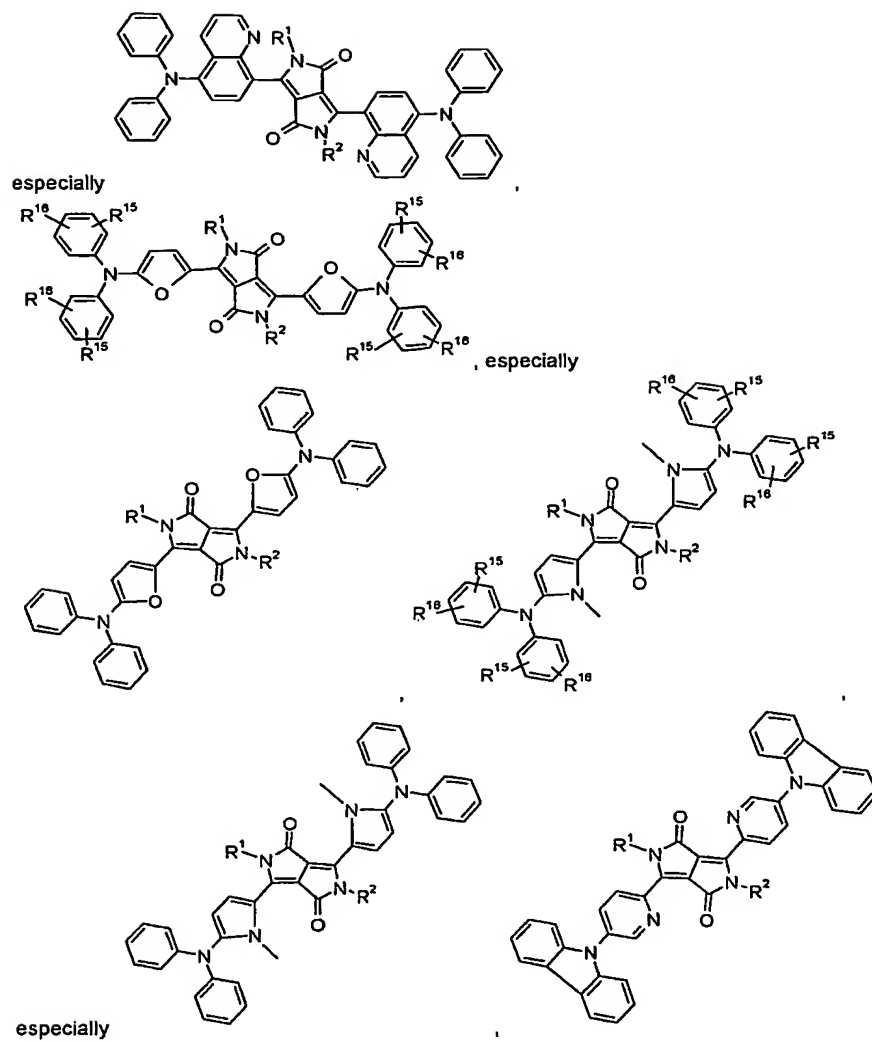
71

alkoxy, or phenyl,  $R^5$  is  $R^5$ , except hydrogen,  $R^5$  and  $R^6$  independently from each other stands for hydrogen,  $C_1$ - $C_8$ -alkyl or  $C_1$ - $C_8$ -alkoxy, and  $X^1$  stands for hydrogen, or  $C_1$ - $C_8$ -alkyl.

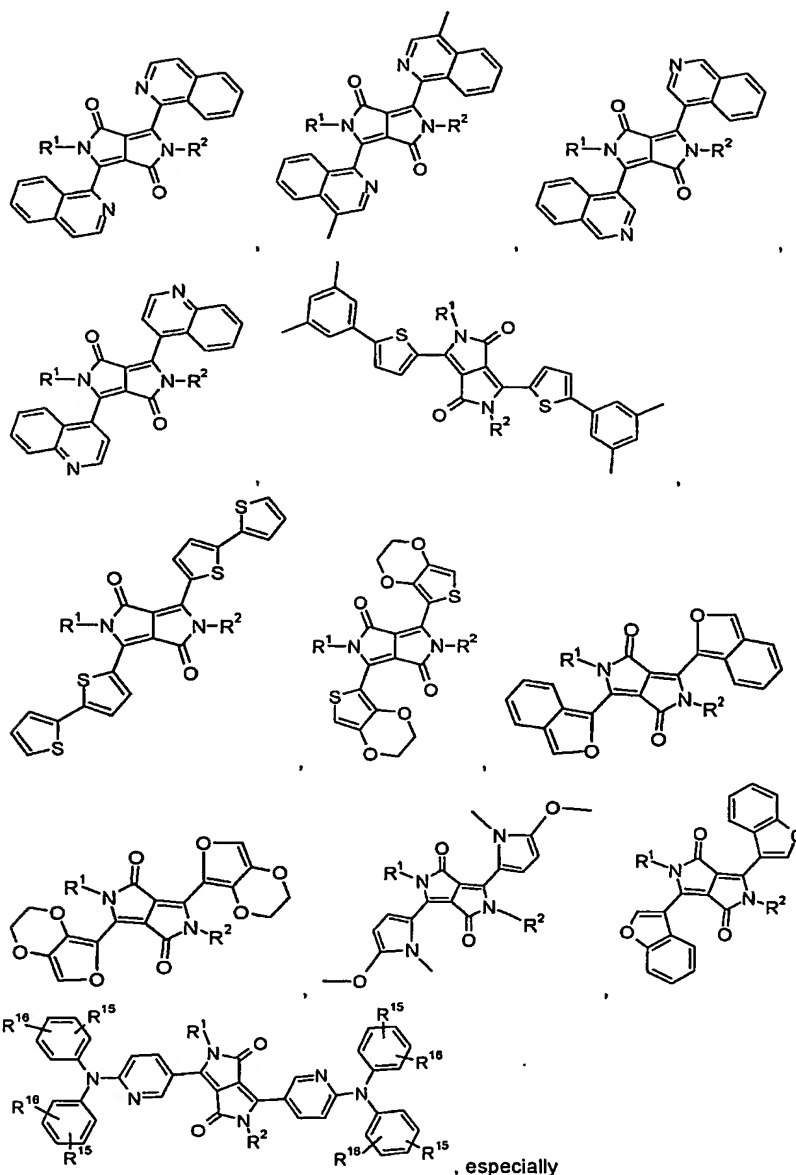
- 5 4. A fluorescent diketopyrrolopyrrole according to claim 3, which is



72



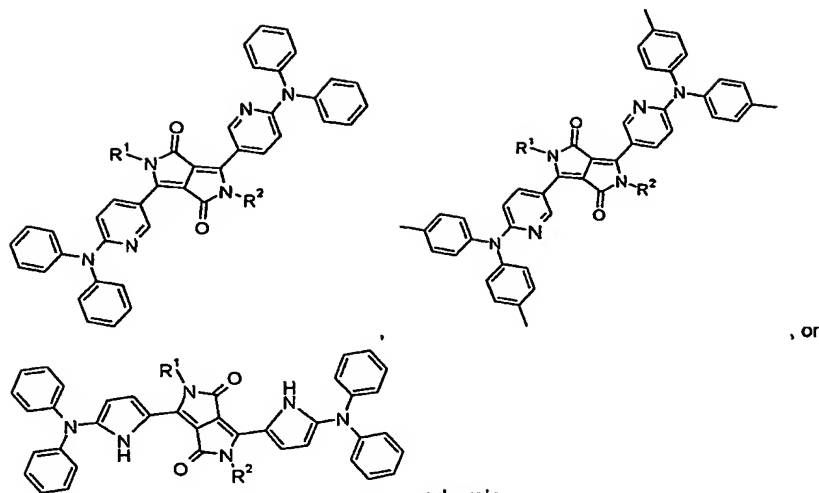
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**, especially**



74



, wherein

R<sup>1</sup> and R<sup>2</sup> are independently of each other a C<sub>1</sub>-C<sub>12</sub>alkyl group, such as methyl, ethyl, n-propyl, isopropyl, n-butyl, sec.-butyl, isobutyl, tert.-butyl, n-pentyl, 2-pentyl, 3-pentyl, 2,2-dimethylpropyl, n-hexyl, n-heptyl, n-octyl, 1,1,3,3-tetramethylbutyl and 2-ethylhexyl, n-nonyl, n-decyl, n-undecyl, n-dodecyl, a C<sub>5</sub>-C<sub>7</sub>cycloalkyl group, which optionally can be substituted by one to three C<sub>1</sub>-C<sub>8</sub>alkyl or C<sub>1</sub>-C<sub>8</sub>alkoxy groups, a C<sub>5</sub>-C<sub>7</sub>cycloalkyl group, which can be substituted one to three times with C<sub>1</sub>-C<sub>8</sub>alkyl and/or C<sub>1</sub>-C<sub>8</sub>alkoxy, or which can be condensed one or two times by optionally substituted phenyl, or a C<sub>7</sub>-C<sub>14</sub>aralkyl group, which optionally can be substituted by one to three C<sub>1</sub>-C<sub>8</sub>alkyl or C<sub>1</sub>-C<sub>8</sub>alkoxy groups, and R<sup>15</sup> and R<sup>16</sup> stands for hydrogen, C<sub>1</sub>-C<sub>8</sub>alkyl, C<sub>1</sub>-C<sub>8</sub>alkoxy, or phenyl.

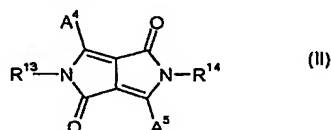
5. A composition comprising a guest chromophore and a host chromophore, wherein the absorption spectrum of the guest chromophore overlaps with the fluorescence emission spectrum of the host chromophore, wherein the host chromophore is a diketopyrrolopyrrole having a photoluminescence emission peak at 500 to 720 nm, preferably 520 to 630 nm, most preferred 540 to 600 nm and wherein the host chromophore and/or the guest chromophore is a diketopyrrolopyrrole of formula I according to any of claims 1 to 4.
6. A composition comprising a guest chromophore and a host chromophore, wherein the absorption spectrum of the guest chromophore overlaps with the fluorescence emission

75

spectrum of the host chromophore, wherein the host chromophore is a diketopyrrolopyrrole having a photoluminescence emission peak at 500 to 720 nm, preferably 520 to 630 nm, most preferred 540 to 600 nm and wherein the guest chromophore is a diketopyrrolopyrrole of formula I according to any of claims 1 to 5.

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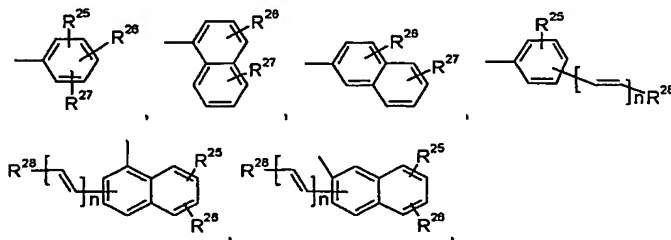
7. A composition according to claim 6, wherein the host chromophore is a diketopyrrolopyrrole ("DPP") represented by formula II



wherein  $R^{13}$  and  $R^{14}$  independently from each other stand for  $C_1$ - $C_{25}$ -alkyl, which can be substituted by fluorine, chlorine or bromine,  $C_5$ - $C_{12}$ -cycloalkyl or  $C_5$ - $C_{12}$ -cycloalkyl, which can be condensed one or two times by phenyl which can be substituted one to three times with  $C_1$ - $C_4$ -alkyl, halogen, nitro or cyano, silyl,  $A^6$  or  $-CR^{11}R^{12}-(CH_2)_m-A^6$ , wherein  $R^{11}$  and  $R^{12}$  independently from each other stand for hydrogen, fluorine, chlorine, bromine, cyano or  $C_1$ - $C_4$ -alkyl, which can be substituted by fluorine, chlorine or bromine, or phenyl which can be substituted one to three times with  $C_1$ - $C_4$ -alkyl,  $A^6$  stands for phenyl or 1- or 2-naphthyl which can be substituted one to three times with  $C_1$ - $C_8$ -alkyl,  $C_1$ - $C_8$ -alkoxy, halogen, nitro, cyano, phenyl, which can be substituted with  $C_1$ - $C_8$ -alkyl or  $C_1$ - $C_8$ -alkoxy one to three times,  $-NR^{23}R^{24}$ , wherein  $R^{23}$  and  $R^{24}$  represent hydrogen,  $C_1$ - $C_{25}$ -alkyl,  $C_5$ - $C_{12}$ -cycloalkyl or  $C_6$ - $C_{24}$ -aryl, in particular phenyl or 1- or 2-naphthyl which can be substituted one to three times with  $C_1$ - $C_8$ -alkyl,  $C_1$ - $C_8$ -alkoxy, halogen or cyano, or phenyl, which can be substituted with  $C_1$ - $C_8$ -alkyl or  $C_1$ - $C_8$ -alkoxy one to three times, and  $m$  stands for 0, 1, 2, 3 or 4,

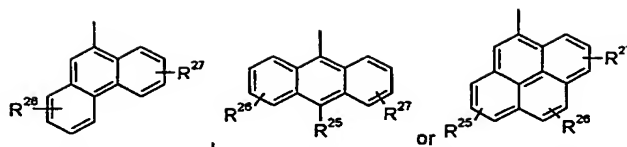
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$A^4$  and  $A^5$  independently from each other stand for



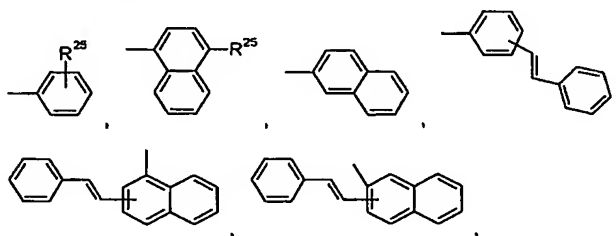
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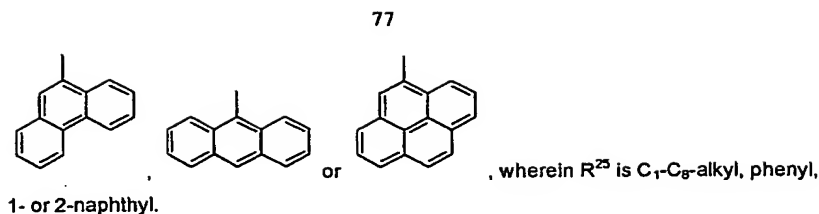
76



wherein  $R^{25}$ ,  $R^{26}$ ,  $R^{27}$  independently from each other stands for hydrogen,  $C_1$ - $C_{25}$ alkyl,  $-CR^{11}R^{12}$ ,  $(CH_2)_m-A^6$ , cyano, halogen,  $-OR^{29}$ ,  $-S(O)_pR^{30}$ , or phenyl, which can be substituted one to three times with  $C_1$ - $C_8$ alkyl or  $C_1$ - $C_8$ alkoxy, wherein  $R^{29}$  stands for  $C_1$ - $C_{25}$ alkyl,  $C_5$ - $C_{12}$ -cycloalkyl,  $-CR^{11}R^{12}-(CH_2)_m-Ph$ ,  $C_6$ - $C_{24}$ -aryl, or a saturated or unsaturated heterocyclic radical comprising five to seven ring atoms, wherein the ring consists of carbon atoms and one to three hetero atoms selected from the group consisting of nitrogen, oxygen and sulfur,  $R^{30}$  stands for  $C_1$ - $C_{25}$ alkyl,  $C_5$ - $C_{12}$ -cycloalkyl,  $-CR^{11}R^{12}-(CH_2)_m-Ph$ ,  $R^{28}$  stands for  $C_2$ - $C_{20}$ -heteroaryl or  $C_6$ - $C_{24}$ -aryl,  $p$  stands for 0, 1, 2 or 3,  $m$  and  $n$  stands for 0, 1, 2, 3 or 4.

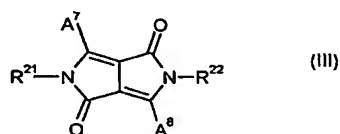
8. A composition according to claim 6 or 7, wherein  $R^{13}$  and  $R^{14}$  independently from each other stand for  $C_1$ - $C_8$ alkyl,  $C_5$ - $C_{12}$ -cycloalkyl, which can be substituted one to three times with  $C_1$ - $C_8$ alkyl and/or  $C_1$ - $C_8$ alkoxy, phenyl or 1- or 2-naphthyl which can be substituted one to three times with  $C_1$ - $C_8$ alkyl and/or  $C_1$ - $C_8$ alkoxy, or  $-CR^{11}R^{12}-(CH_2)_m-A^6$  wherein  $R^{11}$  and  $R^{12}$  stand for hydrogen, or  $C_1$ - $C_4$ alkyl,  $A^6$  stands for phenyl or 1- or 2-naphthyl, which can be substituted one to three times with  $C_1$ - $C_8$ alkyl and/or  $C_1$ - $C_8$ alkoxy, and  $m$  stands for 0 or 1.
9. A composition according to any of claims 6 to 8, wherein  $A^4$  and  $A^5$  independently from each other stand for





10. An EL device comprising a fluorescent diketopyrrolopyrrole according to any of claims 1 to 4 or a composition according to any of claims 5 to 9.

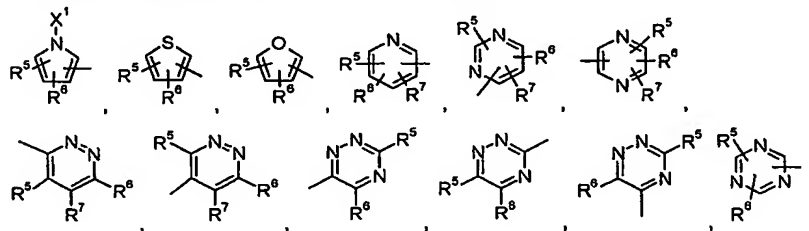
11. A diketopyrrolopyrrole of formula III



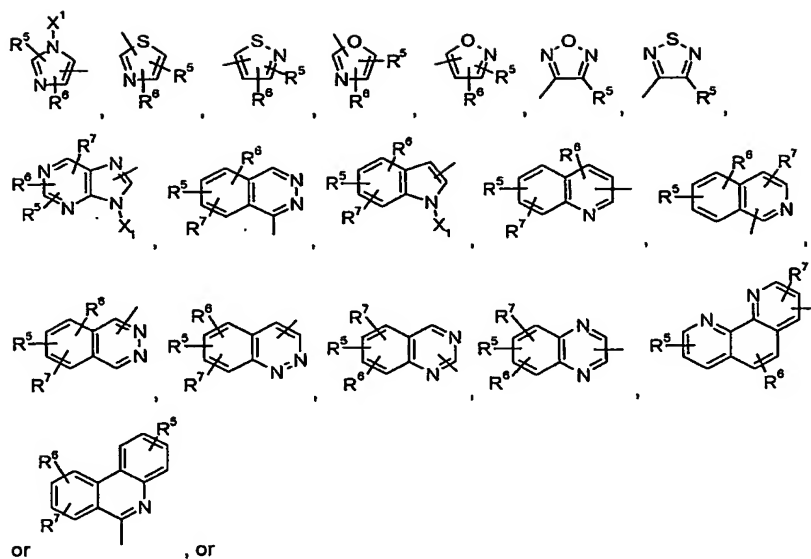
, wherein

- $R^{21}$  and  $R^{22}$  may be the same or different and are selected from a  $C_1$ - $C_{25}$ alkyl group, an allyl group, which can be substituted one to three times with  $C_1$ - $C_4$ alkyl, a cycloalkyl group, which can be condensed one or two times by phenyl which can be substituted one to three times with  $C_1$ - $C_4$ alkyl, halogen, nitro or cyano, an alkenyl group, a cycloalkenyl group, an alkynyl group, a haloalkyl group, a haloalkenyl group, a haloalkynyl group, a ketone or aldehyde group, an ester group, a carbamoyl group, a ketone group, a silyl group, a siloxanyl group,  $A^3$  or  $-CR^3R^4-(CH_2)_m-A^3$  wherein  $R^3$  and  $R^4$  independently from each other stand for hydrogen or  $C_1$ - $C_4$ alkyl, or phenyl which can be substituted one to three times with  $C_1$ - $C_4$ alkyl,  $A^3$  stands for aryl or heteroaryl, in particular phenyl or 1- or 2-naphthyl which can be substituted one to three times with  $C_1$ - $C_8$ alkyl and/or  $C_1$ - $C_8$ alkoxy, and  $m$  stands for 0, 1, 2, 3 or 4,

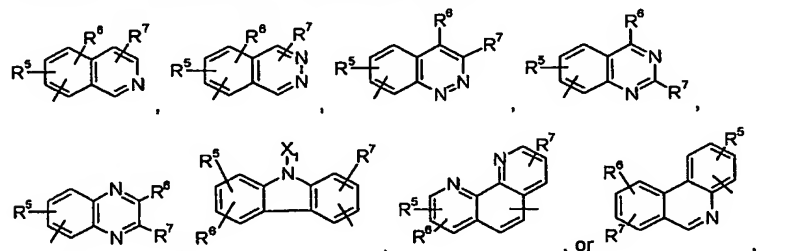
$A^7$  and  $A^9$  independently from each other are selected from



78



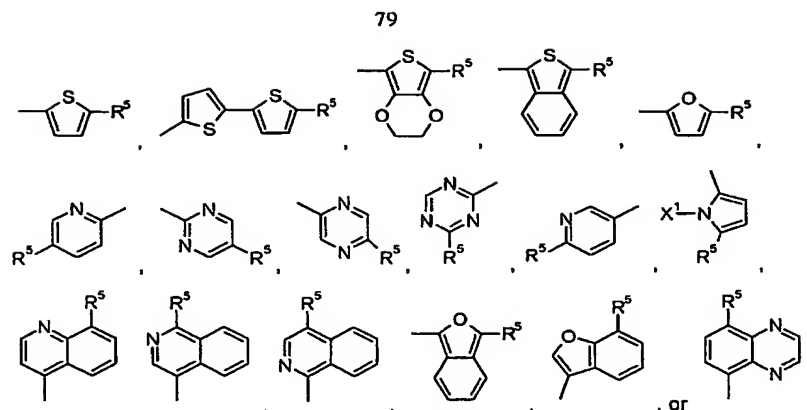
5  $A^1$  and  $A^2$  are independently of each other a group



wherein

wherein one of  $R^5$ ,  $R^6$  and  $R^7$  is a halogen atom, like a chlorine atom, a bromine atom  
 10 or a iodine atom, and the others are as defined in claim 1 and  $X^1$  is as defined in claim 1.

12. A diketopyrrolopyrrole of formula III according to claim 11, wherein  $A^7$  and  $A^8$  independently from each other are selected from



wherein  $R^5$  is a chlorine atom or a bromine atom and  $X^1$  is as defined in claim 1.

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13. Composition comprising

(a) 0.01 to 50% weight, based on the total weight of the colored high molecular weight organic material, of a fluorescent diketopyrrolopyrrole according to any of claims 1 to 4 or a composition according to any of claims 5 to 9,

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(b) 99.99 to 50% by weight, based on the total weight of the colored high molecular weight organic material, of a high molecular weight organic material, and  
(c) if desired, customary additives in effective amounts.

14. Use of the fluorescent diketopyrrolopyrrole according to any of claims 1 to 4 or a

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composition according to any of claims 5 to 9 for coloring a high molecular weight organic material, as fluorescent tracers, in color changing media, in solid dye laser, EL laser and in EL devices.

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